(ii) an extended abstract (up to 2 pages, including figures and tables) by Dec. 20, 2019

Applying for ITO deposition on a-Si:H passivating layer
using four targets facing sputtering cathode and its effect

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1. Background

We developed low damage sputtering cathode (called RAM Cathode) using four targets facing sputtering technology. We applied for HIT-PV which had high transmittance very thin a-Si:H passivation layer to increase its efficiency. Because, the thin passivation is easy to break by sputtering damage[1]. The advanced properties of RAM Cathode are shown in this abstract.

1. Experimental

iVoc and Carrier Lifetime are measured by test pieces shown by Fig1. RAM Cathode and Rotary Cathode were used for ITO sputtering deposition on a-Si:H(i) passivating layer. The schematics of these sputtering concept are shown by Fig2.

 

Fig1. Test piece stacking (a) Rotary Cathode (b) RAM Cathode

 Fig2. Schematics of the sputtering concept

1. Results

The results are shown by Fig3 and 4, Table1 to 3. These say that RAM Cathode has a potential for increasing efficiency of HIT-PV.



(a) Rotary Cathode (b) RAM Cathode

Fig3. Results of iVoc measurement [2]

Table1. The comparison of iVoc between Rotary Cathode and RAM Cathode

|  |  |  |  |
| --- | --- | --- | --- |
| iVoc | Rotary | RAM | Without ITO |
| Before deposition | 710mV | 715mV | 715mV |
| After deposition/ Before annealing | 680mV | 700mV | --- |
| After annealing | 718mV | 732mV | 730mV |



(a) Rotary Cathode (b) RAM Cathode

Fig4. Results of Carrier Lifetime measurement [2]

Table2. The comparison of Carrier Lifetime between Rotary Cathode and RAM Cathode

|  |  |  |  |
| --- | --- | --- | --- |
| Carrier Lifetime | Rotary | RAM | Without ITO |
| Before deposition | 760µs | 800µs | 900µs |
| After deposition/ Before annealing | 300µs | 440µs | --- |
| After annealing | 750µs | 2080µs | 2800µs |

Table3. The comparison of Electrical properties between Rotary Cathode and RAM Cathode

(as deposition)

|  |  |  |
| --- | --- | --- |
| Electrical Properties | Rotary | RAM |
| Resistivity | 7.75µΩm | 5.35µΩm |
| Hall Mobility | 18.6cm2･V-1･s-1 | 38.6 cm2･V-1･s-1 |
| Carrier Density | 4.33×1020 | 3.03×1020 |

1. Summary

It is thought that following results using RAM Cathode has a enough potential to increase the efficiency of HIT-PV.

- Higher iVoc : before ITO deposition 715mV 🡪 after annealing 732mV

- Longer Carrier Lifetime : before ITO deposition 760µs 🡪 after annealing 750µs

- Higher Hall Mobility : 38.6cm2･V-1･s-1 (as deposition)

1. References

[1] S. D. Wolf, B. Demaurex, et. al., Phys. Rev. B 83, 23 (2011).

[2] V. Linss, M. Bivour, H. Iwata, et. al., SiliconPV 2019

1. Acknowledgement

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